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By

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Presidential Address

By DR. J. G. ADAMI

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Gentlemen,

If I mistake not this is the first occasion upon which a pathologist, a student of the science of Medicine, has been honoured by being called to preside over this section of the Royal Society of Canada, wherefore it is fitting that I should embrace the occasion to proclaim the faith that is in me, or, what is equivalent, to place before you my views regarding the scientific aspect of medicine. I will not enter into that ancient discussion as to whether medicine has a right to be termed a science: I will only lay down that to the extent that medical investigation and diagnosis are conducted by methods of precision and medical treatment is based upon results of exact observation—to that extent medicine is a Science. And yearly this extent is increasing. Yearly therefore medicine is becoming more and more scientific. It is futile to object that it is a hodge-podge of many sciences—morphology physiology, physics, chemistry and, in fact, all the sciences, save perhaps geology and astronomy. But even with these latter two, so far as mineralogy is a part of geology, the study of the characters and structures of calculi brings the medical investigator into close touch with the mineralogist, while my friend Dr. Armand Ruffer of Alexandria, by his studies upon the diseases of mummies of 2000 and more B.C., is preparing the way for microscopic investigation into the diseases of preglacial man. And if we no longer cast nativities or regard lunatics as influenced by our earth's pale satellite, we still meet with cases of sunstroke and, with the astronomer, are interested in the ultra-violet and other rays emanating from the sun. There is no science, except pure mathematics, that is wholly pure; astronomy, exalted, not to say celestial, as it is, has become a mixture of mathematics, optics and physical chemistry. If we in medicine depend for illumination upon the data offered by workers in many departments of science we are proud of the fact. We are members of no narrow sect, adherents to no one-'ology' or 'pathy.' We embrace every well-established discovery in the whole domain of science, however remote it may appear, however recondite, if so be that thereby we are aided in our insight into disease and in the alleviation of human suffering. And I hope to show you that we are aiding and advancing those other sciences. How much we are depending upon them, to what extent

medical men of to-day are becoming specialists in remote branches of knowledge may not be generally realized. It has struck me that I might serviceably bring these matters to your notice.

The use of the older medical instruments has become so much the property of the most ordinary practitioner that we are apt to forget that these are instruments of precision, affording exact results and making medicine scientific. Even the crudest of them, the use of the finger in percussion by Auenbrugger and of the stethoscope by Laennec, opened up new worlds in the diagnosis and sure recognition of respiratory disease. Their employment was based upon a knowledge and study of the principles of acoustics by medical men. We are apt to regard Helmholtz as a great physicist, and to forget that the great demonstrator of the conservation of energy (and inventor of the opthalmoscope) was first a medical student, next an assistant surgeon in the regiment of Red Hussars, next a lecturer in Anatomy in Berlin and then Professor of Physiology in Königsberg. It was through physiology that Helmholtz approached physics. And on our part, now that opthalmoscope, stethoscope and microscope are every-day instruments, we are apt to forget what each has meant for the advance of Medical science. In the hands of medical users each has undergone successive improvements and new applications, until the stethoscope has given place to the phonendoscope, with magnification of the sounds produced by the different organs in action: the employment of electric light renders modern opthalmoscopy almost child's play, so clear and exquisite are the pictures afforded of the interior of the eye: the principles of the laryngoscope have been so applied and expanded that with bronchoscope, gastroscope, cystoscope and other special instruments we can investigate the air passages, œsophagus, stomach, bladder and many other ducts and cavities of the body and thereby discover the actual sites of disease when previously we could but infer their existence. I will not pretend that the pre-instrumental period did not develop physicians of singularly acute observation; I firmly believe that the older generations excelled the physicians of to-day in tactile, visual and auditory *finesse*, and in mental grasp and power of reasoning. Admitting this, it must also be admitted that a single phenomenon, accurately seen and recorded, means an exact observation, means a positive datum in place of a possibly erroneous deduction.

But it is to some of the more recent specialisations in medical science that I would more particularly draw your attention.

There is no hospital of the first class nowadays but has its X-ray department, presided over by an expert; we have journals devoted to medical radiography full of discussions upon the minutiæ of measuring the intensity of Röntgen rays, of tests of the value of the different

orders of rays, of debates upon the respective value of radium and radium emanations. One of the medical members of our Society, Dr. Girdwood, was, if I mistake not, the first to employ the principle of the stereoscope to X-ray photography, and thereby to determine the spatial relationship of the shadows one to the other.

Since Professor Waller at the British Medical Association meeting in Montreal in 1897 gave his demonstration of the alterations in the electrical state of the two sides of the body brought about with each heart beat, enormous progress has been made in measuring and demonstrating the electrical change in the living heart and its different chambers, so that now we see developing a race of specialists trained to employ that most sensitive of all physical instruments, the capillary electrometer. By its use not only may the work of each individual chamber of the heart be differentiated, but conditions of abnormal action hitherto unrecognized have been brought to light, notably that of auricular fibrillation, a condition in which for months and years, it may be, the auricles are so thrown out of gear that they play no part in propelling the blood, and as a consequence the ventricles do not receive the normal stimulus to contraction but are compelled largely to set the pace for themselves. We thus are gaining a remarkable increase in knowledge of the different types of irregular heart action and their significance. But so delicate is the instrument, so large a familiarity is requisite with the records obtained, that there must be developed a group of specialists devoted to and expert in this one line of work, men who have at the same time a profound knowledge of electricity and of heart disease.

If next we turn to the more biological aspects of medicine, we find the same forces at work. Strictly speaking Bacteriology, the study of bacteria and their habits, is a branch of Botany. Although Ehrenberg and Ferdinand Kohn may be said to have founded the systematic study of the bacteria, if there be any botanist here he must admit that the extraordinary impulse given to observations upon these minute forms of life by the discovery that certain of them are the *causa causans* of disease, has brought about the development of Bacteriology as we at present know it: that the work accomplished in laboratories devoted to medical bacteriology has established the science: that Robert Koch, once a simple country practitioner, developed and established the technique which now all use, be they agricultural or commercial or medical bacteriologists. Here again, so vast has the subject become, so elaborate certain procedures, so extensive a training is necessary for proficiency, that specialism has become essential. This is particularly the case in connection with the application of bacteriological or, more accurately, immunilogical methods to diagnosis and treatment. The study of

the effects of the growth of bacteria within the tissues has brought to light the development of changes in the composition of the blood and body fluids, so delicate as to be beyond the range of chemical analysis, but so important that upon them depend the continued existence or the death of the individual. Properly to employ, for example, the methods for the estimation of opsonins, and to administer vaccines in accordance with the knowledge so gained, demand the trained specialist. The same is true regarding the diagnostic reaction for syphilis afforded by the blood serum. The medical bacteriologist here has evolved methods of a delicacy far beyond any possessed by the organic chemist. They depend, of course, upon chemical changes, but the chemist is in this matter lumbering behind.

Lumbering behind also, I hold, is the non-medical biologist and student of heredity. He in his studies upon heredity and variation is groping, it seems vainly, for evidence of gross morphological change brought about by modifications of environment. He cannot find it, and therefore declares that environment must be 'counted out' as a direct factor in inducing variation. I am filled with wonder and with some impatience that he is so blind as to neglect the pregnant data afforded by medical investigation into the phenomena of immunity. Functional change, obviously, must precede organic or morphological change, and if we can prove that, by altering the environment of the body cells in particular directions, we can permanently after the functions of those body cells, then surely we have established that environment is a factor in the production of variation. Now the evidence that this is so, obtained by the medical bacteriologist, is overwhelming. Take an animal like a rabbit that never in the course of its existence has, or whose ancestors so long as rabbits were rabbits can never have been exposed to a particular toxin, such as *abrin*, the active principle of *Abrus precatorius*, the prayer bean, or to a particular microbe such as the *Cholera spirillum*, which for long flourishing in the delta of the Ganges only reached Europe and America within the last century. Inoculate that rabbit with a small dose of the one or the other, and the animal will die. Inoculate it with a still smaller dose and the animal will not only recover but what is more its body fluids contain a something, absent in the untreated animal, which will neutralise the abrin, or destroy the cholera spirilla. In other words, under the influence of unwonted toxins the body cells now alter their functions and discharge substances which they had not hitherto produced:—specific substances, such that the blood serum of the rabbit immunised against abrin will have no effect upon cholera spirilla and that of the rabbit protected against cholera spirilla does not render abrin harmless. Nor is this a temporary change: it is conveyed to successive cell generations.

After long months a second inoculation with one or other toxin stimulates an immediate, or most rapid and abundant production of the specific antitoxin.

The demonstration is complete and one can afford abundant instances of the same order, proving that functional variation of a permanent type in the individual is produced by variations in cell environment. But I never see the ordinary academic biologist seizing upon these data.

Truth to say, just as our students appear to regard their successive courses of lectures as so many water-tight compartments: seem to hold it anathema to apply what they have acquired in their anatomical teaching to what they see in the out-patient department of the hospital, and seem almost insulted when they are asked to apply physiological or biological data to the elucidation of a pathological problem; so we students of a larger growth are insulted when workers in what we consider a totally different department of science undertake investigations which we regard as the peculiar prerogative of our own particular 'Fach'. It is the same water-tight compartment idea:—'Can any good come out of Nazareth?'

I would willingly have brought before you the work being accomplished by the medical zoologists: by the workers in Tropical Medicine with their valuable studies upon the habits of mosquitos, tabanidae and other insects which act as the carriers of infection: by the medical chemists—the extraordinary synthetic work achieved by Ehrlich, for example, ending in the production of the arsenic compound '606,' which destroys the organisms of sleeping sickness, syphilis and many spirilloses; or the corresponding work of Wassermann which promises to give us a cure for at least some forms of cancerous growth. But this address has already attained and more than attained, its due length. I shall be satisfied if I have shown you not merely that medicine is striving to be yearly more and more scientific, but that medical men working at medical problems along now physical, now chemical, now biological lines are gaining results of the first order of importance not for medicine alone, but for science in general.

It is good to think that work of this order is now emanating out of Canada—that to mention but one example, one of our colleagues stands foremost as a pioneer in the development of methods of micro-chemistry and thereby has introduced new view-points in cytology and the study of living matter and its properties. May such work continue and increase. Gentlemen, I wish you a most successful and helpful meeting.